# Lesson 3: Overview

This lesson covers the basics of man-made climate change, and what the global effects of it have been and will continue to be.

## Key Ideas

- **Activity 1: Signal vs Noise #3**

  This activity covers the concept of trends in data, and the importance of marking what units of measurement you're using. It also lets students compare the global temperature trend with the Massachusetts temperature trend. Students should notice that while the trends don't match perfectly, they both show warming.
- **Activity 2: Storm Surges and Sea Level Rise**

  By the end of this activity, students should have a grasp of the basics of sea level rise, and an understanding of how storm surges are acting as the vanguard of the rising seas.

## Materials

- Student sheets
- Projector
- Powerpoint packet

Students should be prepared to take notes, either in a paper journal or on the computer.

## Teaching Suggestions

For convenience, you can divide your class into groups of 3-5 students.at the start. Distribute the student sheets at the beginning of the class. Activity 2 is a whole-class discussion activity built around the powerpoint file provided, which includes several videos. It would be a good idea to review the powerpoint materials ahead of time, as you may decide that some of the videos can be cut short to save time without sacrificing content.

# Activity 1: Temperature Change [5-10 minutes?]

## Context for the teacher

The goal of this activity is to cover what's happening to the climate, both at a local and at a global level. In addition to comparing two graphs (local and global temperature change), students will also be required to convert Fahrenheit to Celsius, in order to get an accurate comparison. If you need to cut back on time, you could also do the conversion for them and skip that portion of the activity.

## Flow of the activity

*This is a small group activity.* Questions are on student sheets.
Look at Figure 1 — the graph of global average temperature since 1950.

- What is the overall trend?

Now compare it to Figure 2 — the Massachusetts graph.

- First, what's different about the axes? Are the units of measurement the same? *(No)*

So, in order to compare the two graphs, we need to have them both using the same measurement. Scientists use Celsius instead of Fahrenheit because it's a scale centered on the physical properties of water – 0˚ Celsius is freezing, 100˚ Celsius is boiling.
Convert the numbers on the Massachusetts graph to Celsius. (The formula is 5(N-32) / 9 where N=degrees Fahrenheit)

- Now, what are the differences between the two graphs? *(Massachusetts is colder than the planetary average; local temperatures and global temperatures are not always going to do the same thing)*

- What are the similarities? *(The overall trend, since 1970, has been one of warming)*

# Activity 2: Sea Level and Storm Surges (20+ minutes)

## Context for the teacher

The goal of this activity is to put sea level rise in a more relevant context by examining how it is being felt through storm surges long before any area is permanently flooded. This covers both what storm surges are, and how they can affect human and natural environments. There are about 10 minutes' worth of video in this activity, with the last video being 7 minutes long.

## Flow of the activity

*This is a whole-class discussion activity.*
There are no student materials for this activity. For the most part, you can go through this activity with the powerpoint presentation as a guide.
Start by playing the first video, which gives a brief summary of what we currently know and expect about sea level rise. From there, move into the discussion questions:

- How will we first see the effects of sea level rise? (*Answers: Sea water getting into the groundwater in places like Miami, higher high tides, and storm surges)*
- What is a storm surge? (*Allow some discussion if you like, but then move on to the second video which gives an overview of what storm surges are and why they can be dangerous. If you're pressed for time, feel free to cut the video short when it starts talking about how to prepare for a storm surge.)*

Play the second video, covering the basics of storm surges.

- How will sea level rise cause storm surges to become more of a problem? (*The basic answer is that it has them starting from a higher point. A popular analogy is that of raising the floor of a basketball court a couple inches – suddenly almost everybody can dunk! Likewise, a couple inches are all you need for a storm surge to go from being in safe territory, to flooding everything.)*
- How do storm surges affect ecosystems? (*The answers are provided in the slides, but may bear some discussion after the class reaches or sees them.)*
- How do storm surges affect human environments? (*Again, the answers are in the slides. If the students don't bring up recent hurricanes, it might be worth mentioning them, along with the serious problems Texas had with flooded chemical plants and warehouses.)*
- Since we know higher seas are coming, how can we prepare?

Play the last video. This one is a full 7 minutes long, but worthwhile to see how Holland is approaching sea level rise, and how American cities are seeking their advice.

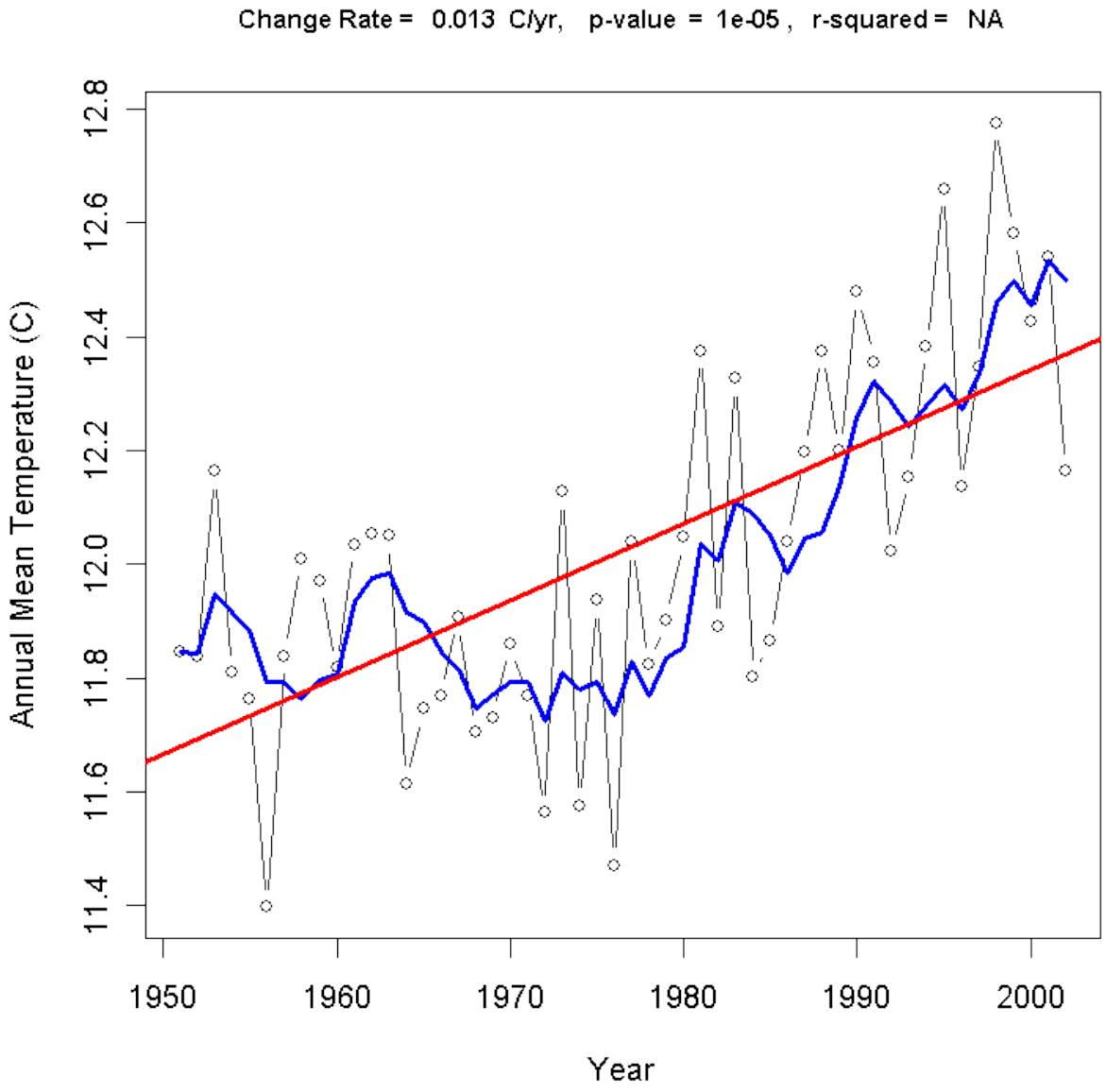


**Figure 1 – Global Average Temperatures**

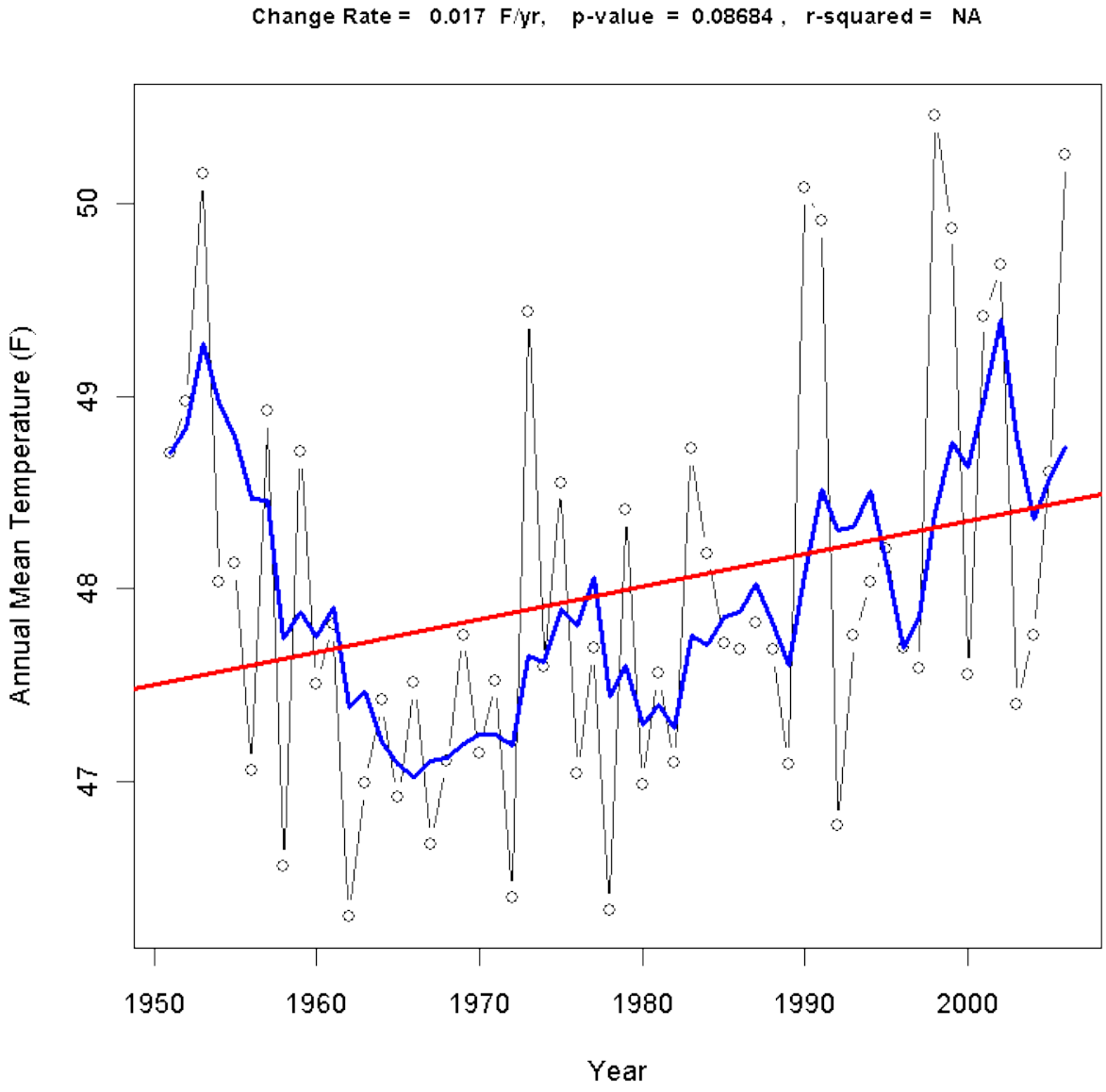


**Figure 2 – Massachusetts Average Temperatures**

# Lesson 3 Review and Vocabulary

## Context for the teacher

These are questions and terms you may find useful either for homework, for reviewing the lesson, or as part of a review of the whole unit for the students. Use them or not as you see fit.

## Review Questions

## Vocabulary:

*Hypothesis:* A proposed explanation for something, made on the basis of available evidence, that can be used as the starting point for further investigation.
*Storm surge*: A rising of the sea as a result of atmospheric pressure changes and wind associated with a storm.